

ORACLE

The Future of Data and AI

Tirthankar Lahiri

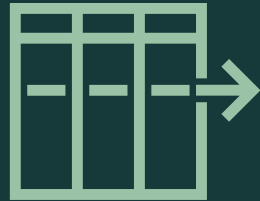
SVP Mission-Critical Data and AI Engines

Oracle



The world of data was once simple

Traditional
OLTP



On relational databases

Traditional
Analytics



On relational databases

Many new and specialized data technologies have been introduced

New Types of Data



Relational



Documents



Spatial



Text

New Types of Analytics



Data Warehouse



Data Lake



Graph



Streaming

New Workload Types



AI



Geo-Distributed



IoT



Blockchain

Modern apps are built by combining specialized databases

New Types of Data



Relational



Documents



Spatial



Text

New Types of Analytics



Data Warehouse



Data Lake



Graph



Streaming

New Workload Types



AI



Geo-Distributed



IoT



Blockchain

Complexity explodes further as we add AI to **every** component

New Types of Data



Relational



Documents



Spatial



Text

New Types of Analytics



Data Warehouse



Data Lake



Graph



Streaming

New Workload Types



AI



Geo-Distributed



IoT



Blockchain

Re-envisioning data management



Eliminate
complexity



Improve
synergy



Increase
efficiency

To achieve simplicity, engineer technology to work seamlessly together

New Types of Data



Relational



Documents



Spatial



Text

New Types of Analytics



Data Warehouse



Data Lake



Graph



Streaming

New Workload Types



AI



Geo-Distributed



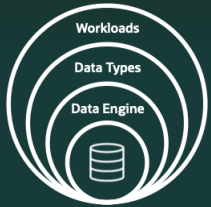
IoT



Blockchain

Oracle engineers data management and app dev together to provide simplicity

Engineered to Work Together



All data types
and workloads



Hardware and
software



OLTP, DW,
and Data Lake



Full mission
critical stack



Apps and
data together

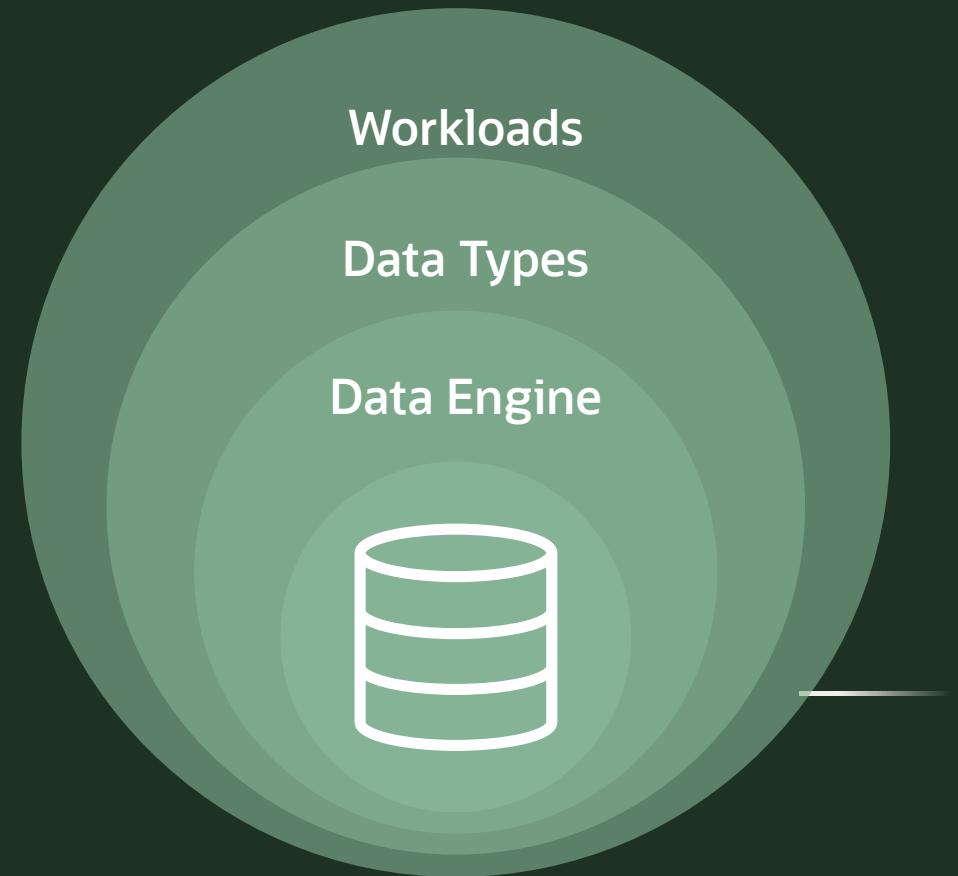


AI and
app dev

Oracle's Database Strategy

Engineer all data types and workloads to work together

— Using a Converged Data Architecture



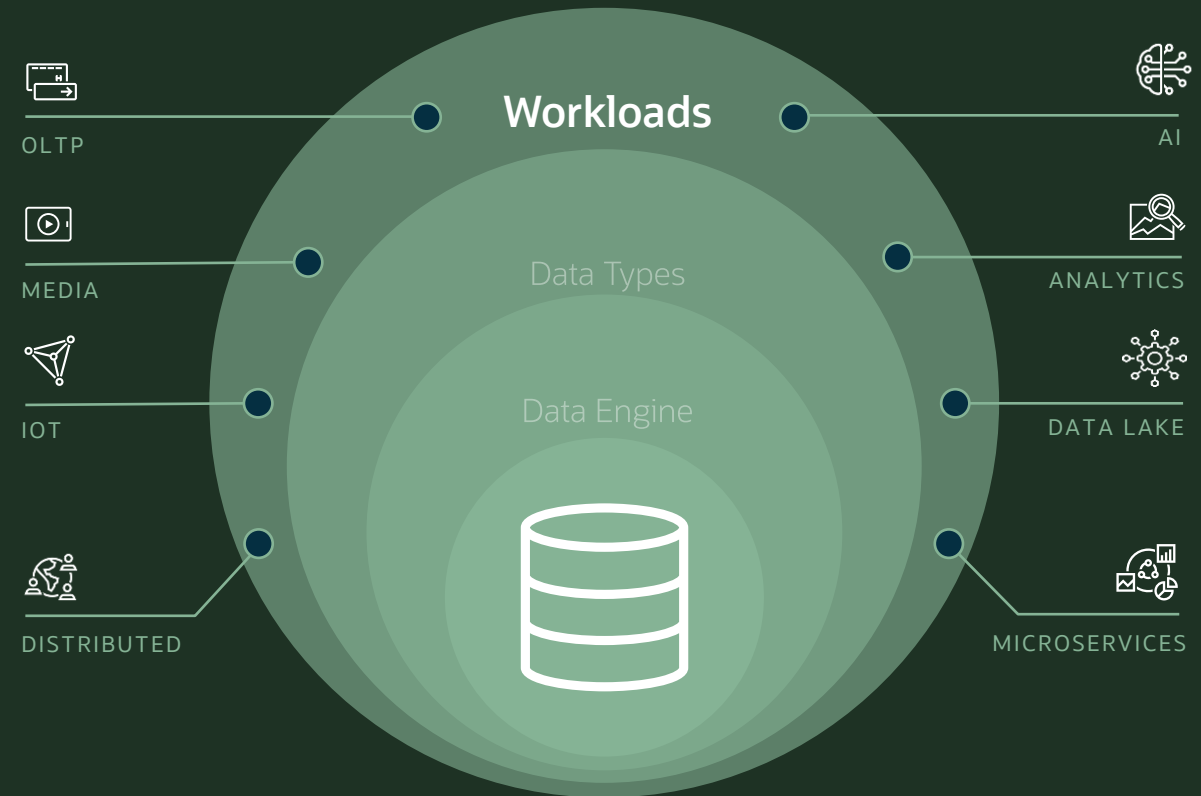
Oracle's converged data architecture supports all key Workloads

Optimized performance for each workload

Scales to meet any need

Comprehensive support for apps using **mixed** workloads

NEW: Support for AI Vectors and Iceberg tables



All **Workloads** are Engineered to Work Together

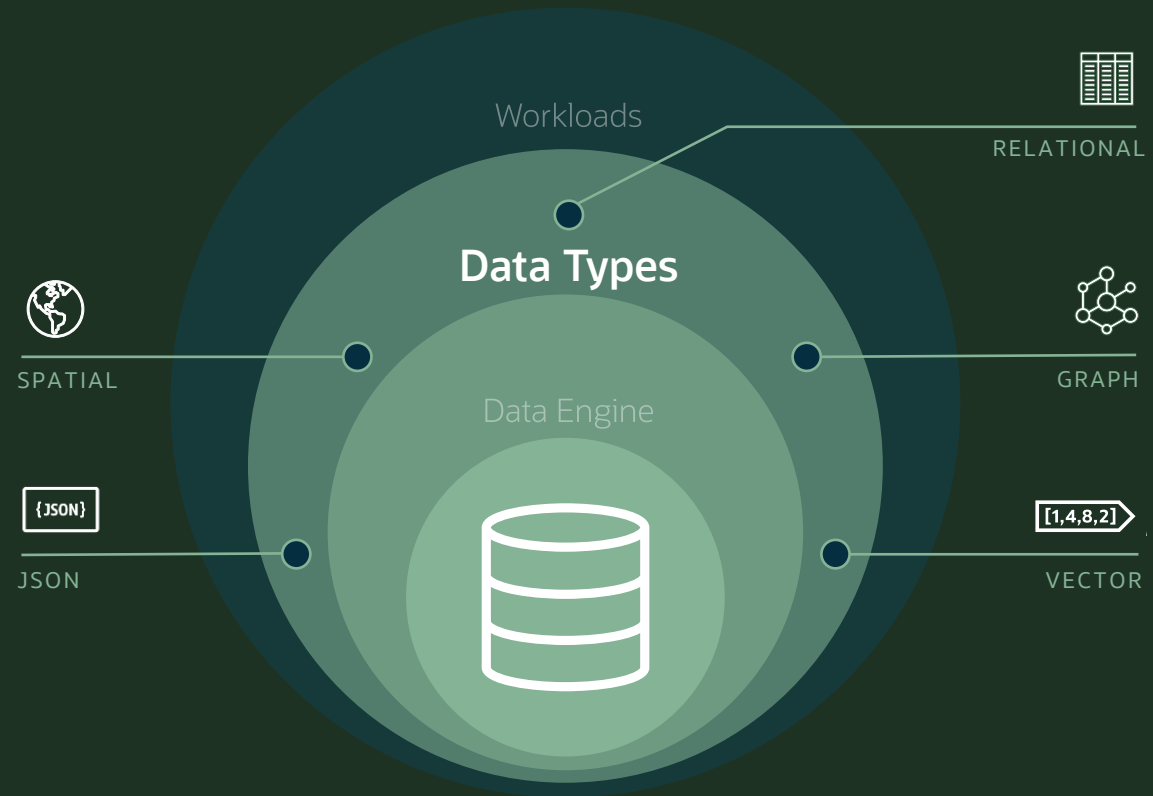
Oracle's converged data architecture supports all key Data Types

Optimized for each type

And ideal for real-world apps that need a mix of multiple types

For a new data type or workload, add a SQL statement, not a DB

NEW: Ultra-fast JSON, MongoDB compatible API, and ISO SQL standard graph queries

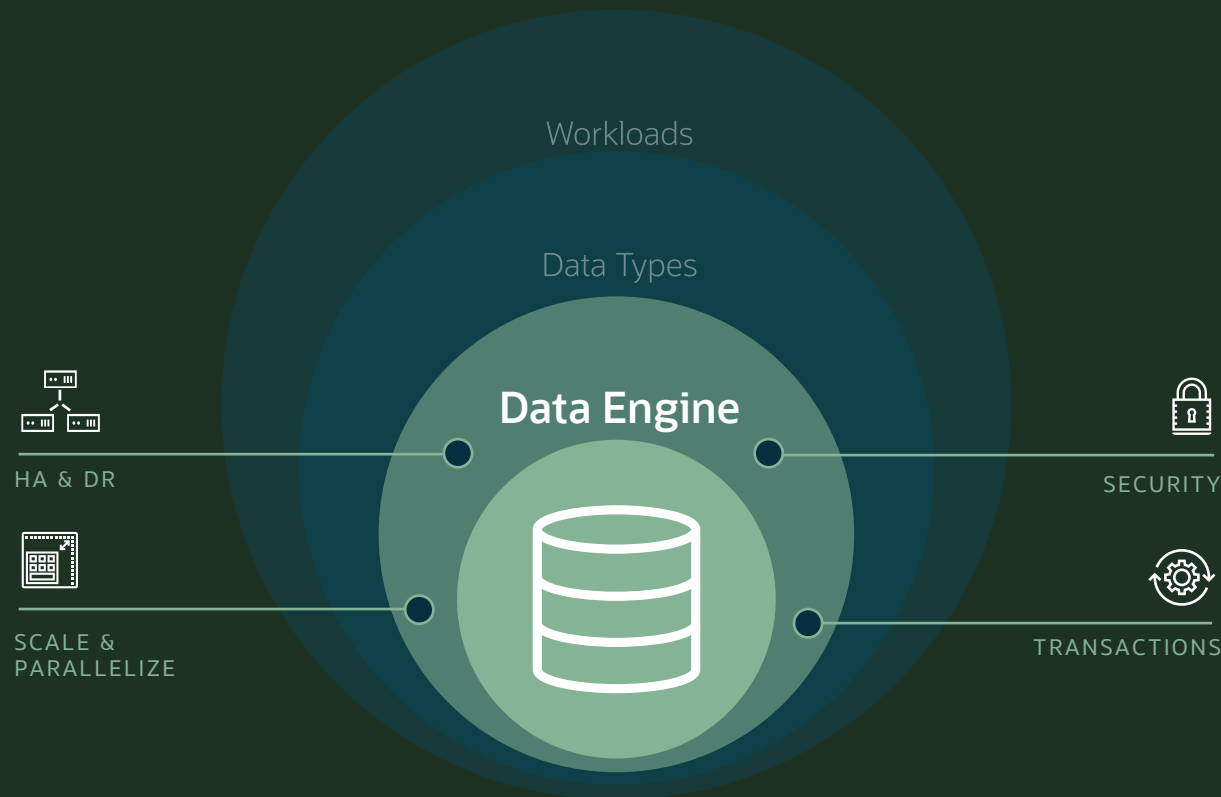


All **Data Types** are Engineered to Work Together

Oracle's converged architecture runs on a common mission-critical **Data Engine**

Transparent atomicity, parallelism, high availability, disaster recovery, and security **across all workloads and data types**

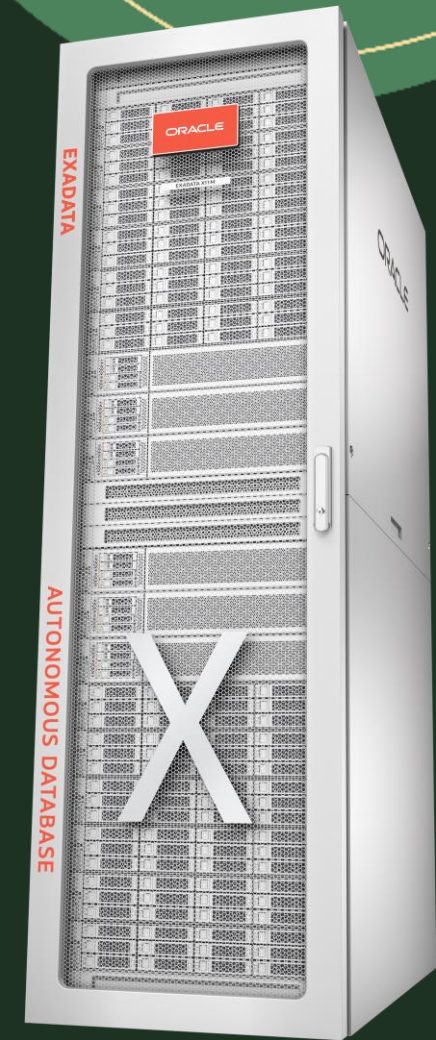
NEW: Lock-free updates and transactional microservices



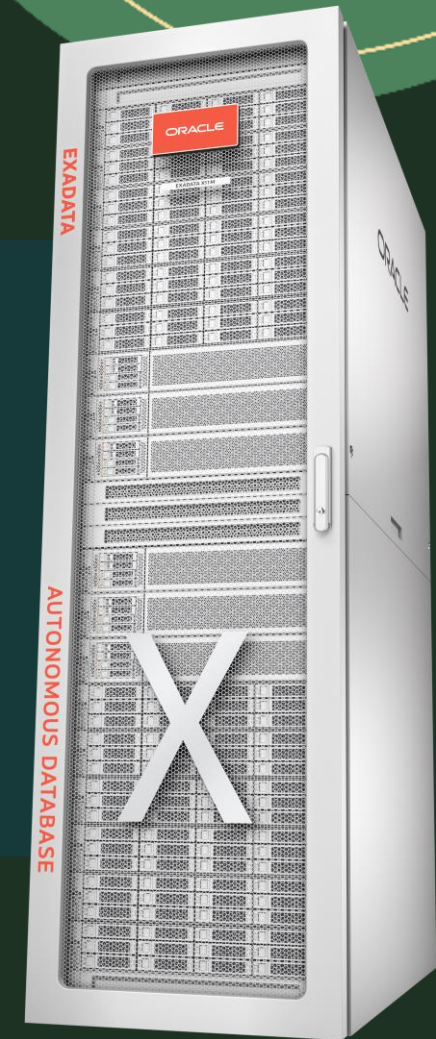
All **Data Operations** are Engineered to Work Together

Oracle's Database Strategy

Engineer hardware and software together, everywhere



Exadata's unique smart storage, scale-out, and RDMA architecture delivers extreme performance and availability for all key workloads while reducing cost



Software and Hardware Engineered to Work Together

Thousands
of global customers
run on Exadata

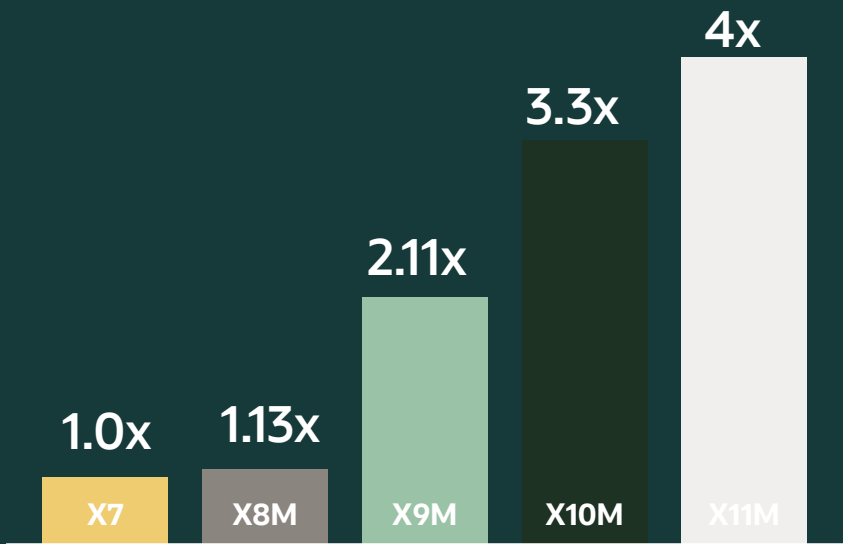
79% of Fortune
Global 100 Run Exadata

58% Run Exadata Cloud



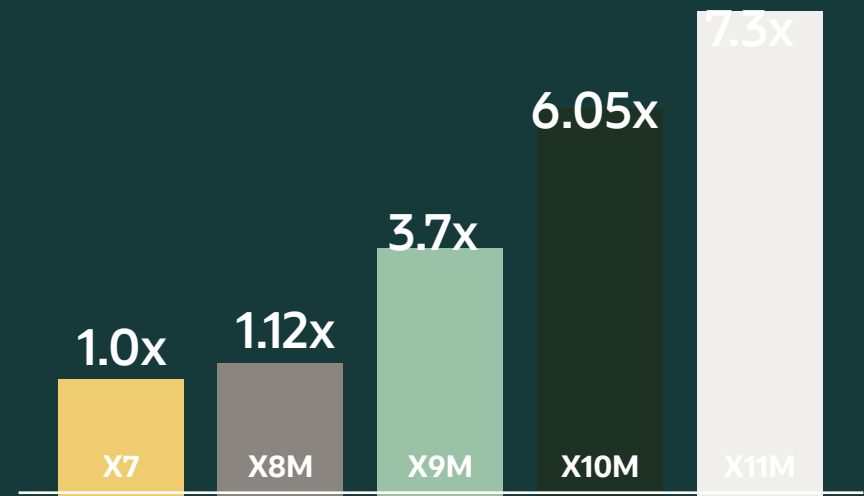
Newest Exadata X11M – more performant and cost-effective than ever

up to **4x** Faster concurrent transaction throughput



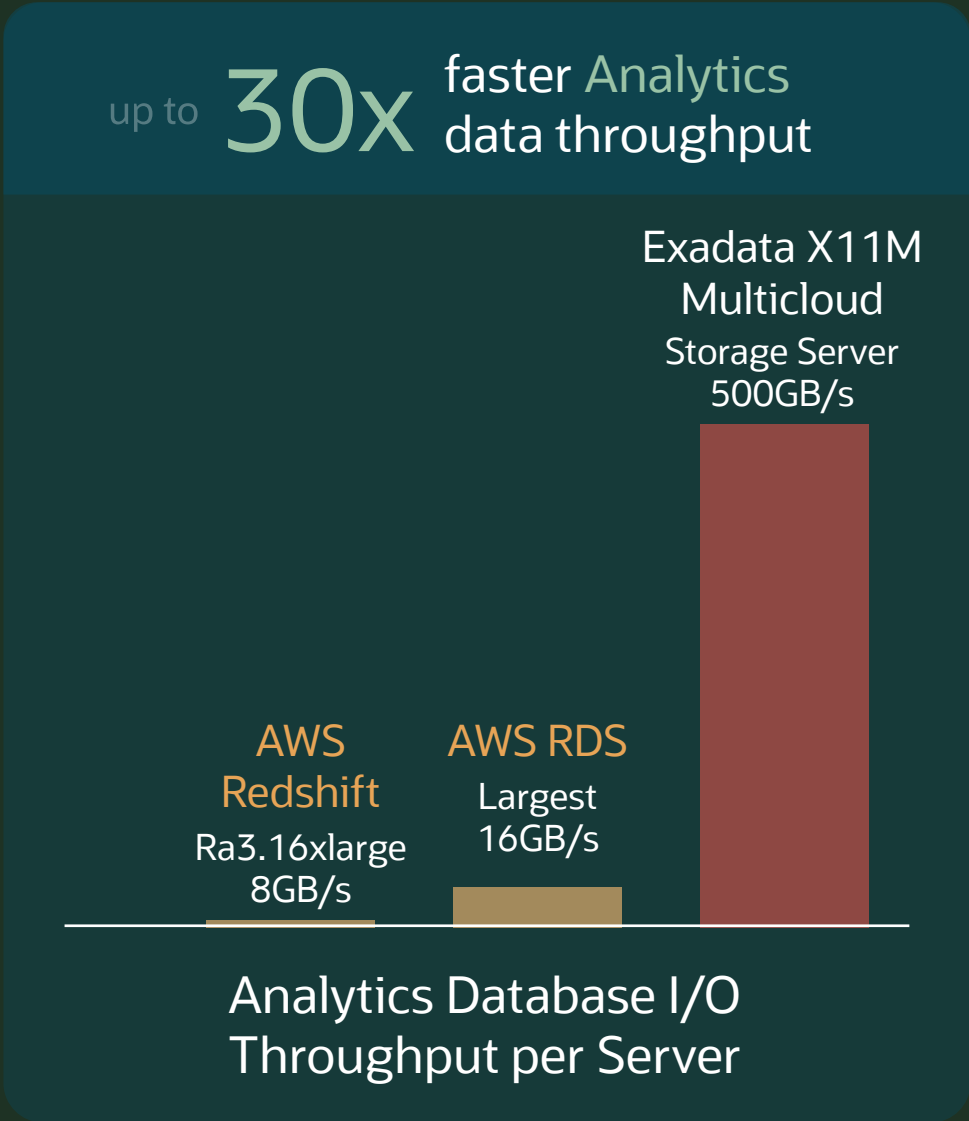
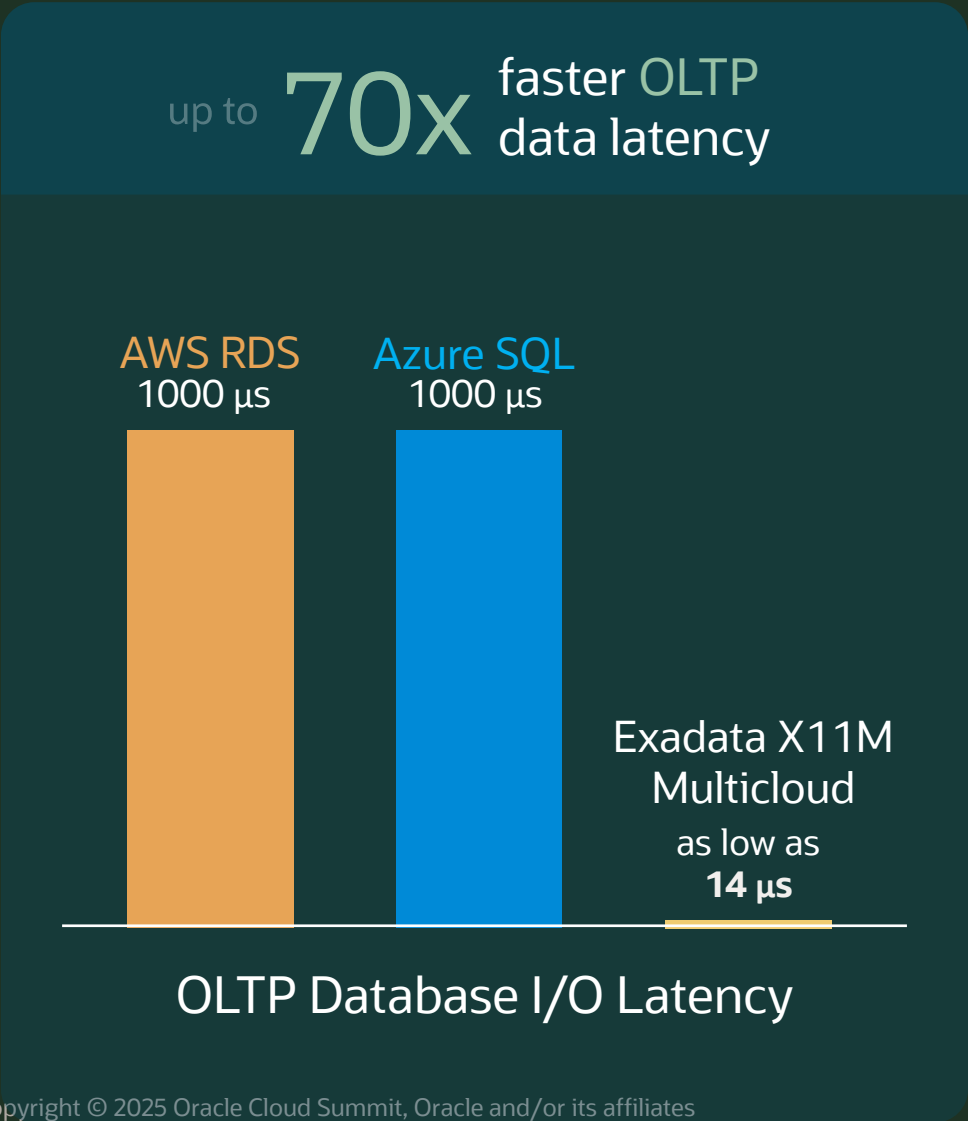
Industry Standard OLTP Benchmark

up to **7.3x** Faster analytic query throughput



Industry Standard 1TB Benchmark

Exadata provides exceptional OLTP data latency and analytic throughput



Exadata Exascale – next generation Exadata software architecture



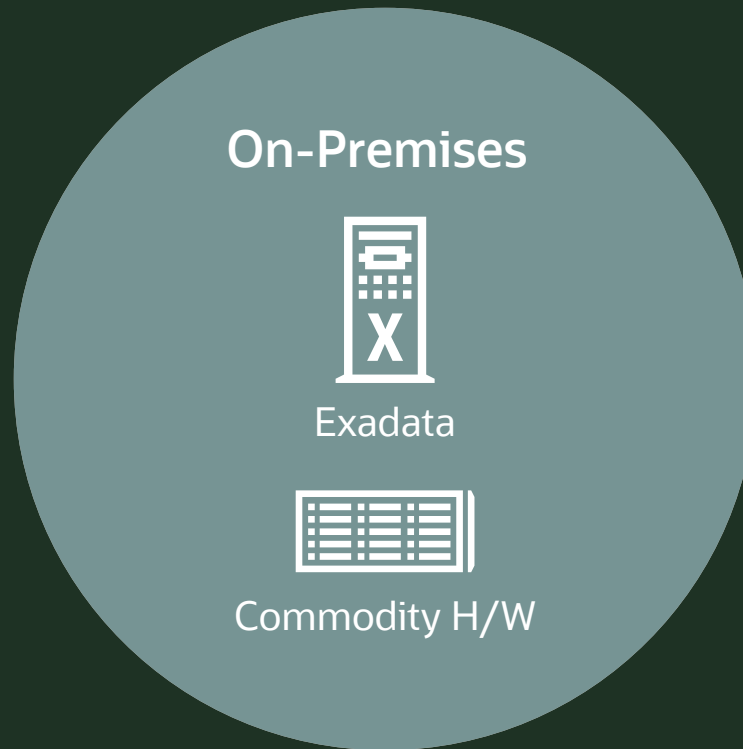
Best of Exadata Plus Best of Cloud Engineered to Work Together

Oracle's Database Strategy

Oracle Database, Exadata, and
Database Cloud run everywhere



In your data center



Exadata

Hardware of your choice

In all leading public clouds

On-Premises



Exadata



Commodity H/W

Cloud

ORACLE
Cloud

OCI



Azure



Google



Amazon

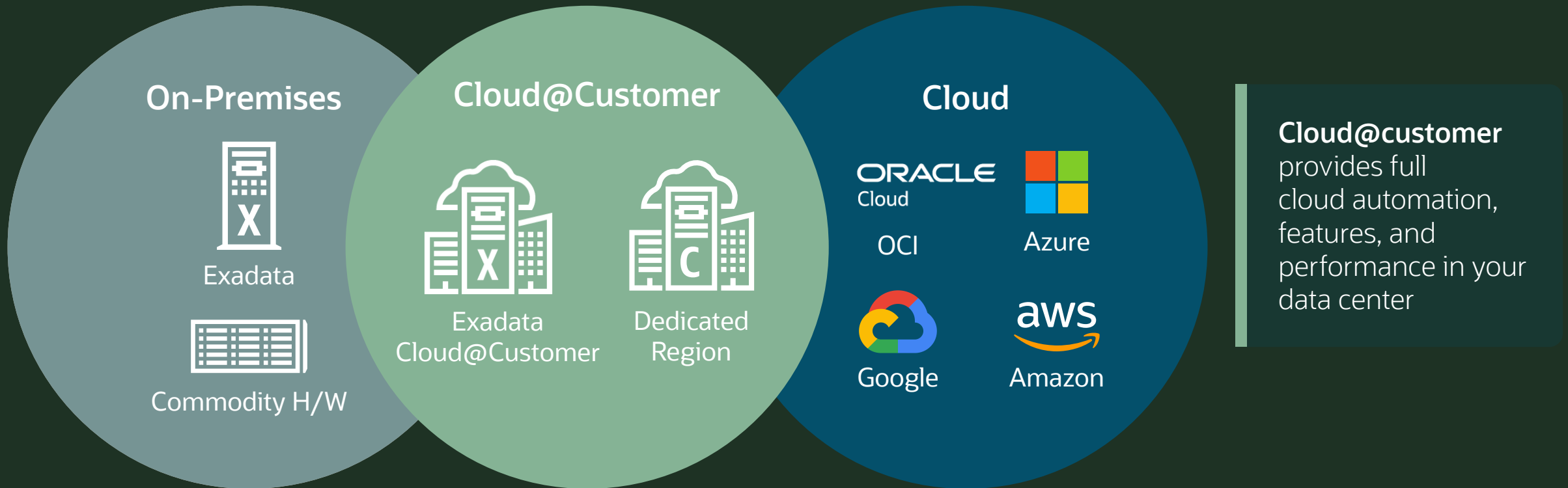
Oracle Database Multicloud

Full Exadata Cloud automation,
features, and performance

Use existing Cloud
Vendor credits

Sub-millisecond latency
from app to database

In your data center as a cloud



Apps and data remain in your data center

Oracle's Database Strategy

Engineer a completely automated
Data Platform that delivers the best of
OLTP, Warehouse, and Data Lake



Oracle Autonomous Database



Oracle Converged Data Architecture on Exadata provided as a fully automated database service

Any app at any scale transparently gets extreme availability with no effort at low cost

Available in all leading public clouds and on-premises

Autonomous
Database powers
1000s of global
enterprises
today

accenture

lyft

AON

FedEx®

GENERALI

Premier
League

experian™

NEC



THOMSON REUTERS



SIEMENS

vodafone

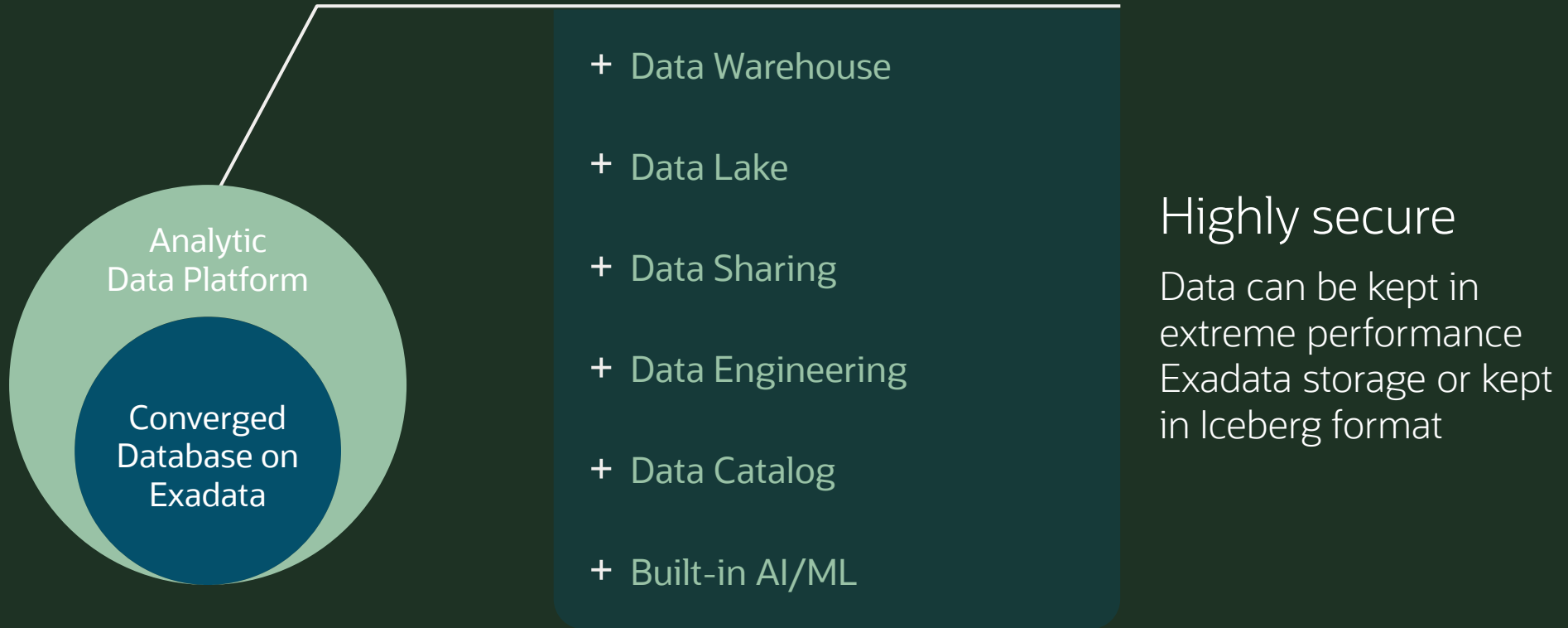
Schneider
Electric

MARS
Veterinary Health

SAIL GP

xerox

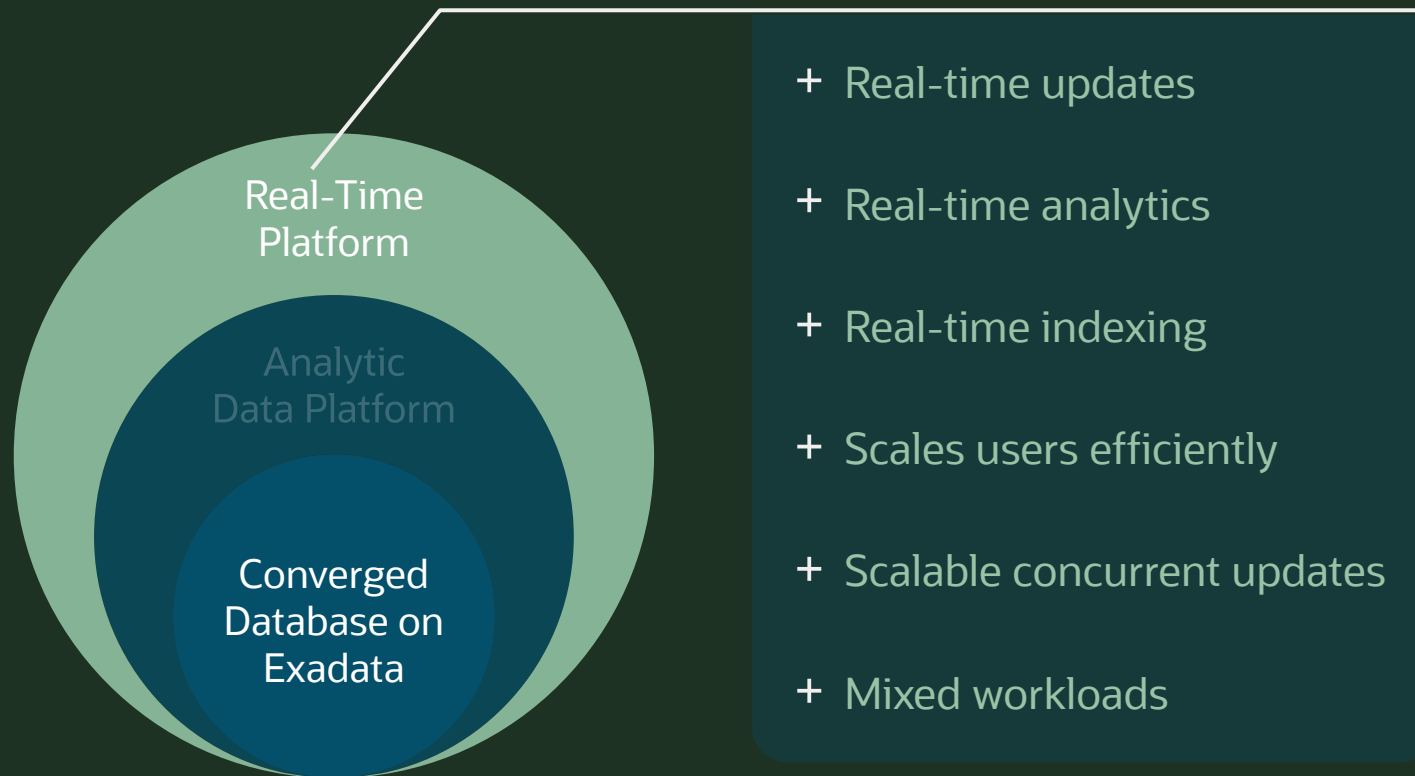
Oracle Autonomous Database is a complete and simple analytic data platform



All **Data Platform Technologies** Engineered to Work Together

Autonomous Database is a unique Translytical Data Platform

Combines the best of OLTP and Analytics



What competitors describe as their vision of the future is available and mature **now** in Autonomous DB

Real-Time and Analytics Engineered to Work Together

Oracle Translytical Data Platform
is rated as having the highest
scores in both the current offering
and strategy categories

Forrester Wave:
Translytical Data Platforms Q4 2024

Authored by Noel Yuhanna
VP, Principal Analyst, Forrester

Source (link forthcoming): <https://reprint.forrester.com/reports/the-forrester-wave-tm-translytical-data-platforms-q4-2024-90b043e6/index.html>

THE FORRESTER WAVE™

Translytical Data Platforms

Q4 2024



Oracle's Database Strategy

Engineer apps and data together



For decades, data professionals have preferred to use relational tables for storing data

SUPREMO

CORPORATION

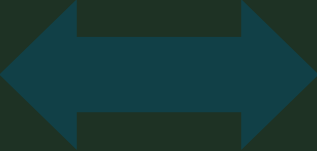
PURCHASE ORDER

P.O. NUMBER	DATE
23781	01/20/2025

CUSTOMER

NAME	PHONE
JOHN SMITH	517-367-7010
COMPANY NAME	EMAIL
SUPREMO CORPORATION	johnsmith@mysmallbiz.org
ADDRESS	DELIVERY INSTRUCTIONS
16050 S. US 22 POLES, MICHIGAN, 43509	

CODE	QUANTITY	PRODUCT DESCRIPTION	UNIT PRICE	AMOUNT
304-98632	4	Brake Discs, Pads & Calipers	111.36	445.44
501-35587	2	Control Arm	60.93	121.86
886-19386	2	Suspension Lift Kit	399.83	799.66



ORDER INFO			
PONUM	DATE	C_ID	INST
...
...
...

CUSTOMER INFO			
C_ID	NAME	PHONE	ADDR
...
...
...


LINE_ITEMS			
PONUM	L_ID	PCODE	QTY
...
...
...

PRODUCT INFO			
PCODE	PNAME	DESC	PRICE
...
...
...



Relational decomposes application data into its **independent reusable components** and stores them as **rows** in separate tables

PURCHASE ORDER

 **SUPREMO CORPORATION**

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ORDER DATA			
PONUM	DATE	C_ID	INST
...
...
...


CUSTOMER DATA			
C_ID	NAME	PHONE	ADDR
...
...
...

LINE_ITEMS DATA			
PONUM	L_ID	PCODE	QTY
...
...
...

PRODUCT DATA			
PCODE	PNAME	DESC	PRICE
...
...
...

Sometimes app developers prefer to store data as JSON documents

PURCHASE ORDER

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501-35587	2	Control Arm	60.93	121.86
886-19386	2	Suspension Lift Kit	399.83	799.66



ORDER RELATED DATA

```
{
  "po number"    : 23781,
  "date"         : "01/20/2025",
  "custid"       : 6543,
  "line items"   :
    [ { "prodID"   : "304-98632",
        "desc"     : "control arm",
        "unitPrice": "121.86",
        "quantity" : 2
      },
      ...
    ]
}
```

CUSTOMER RELATED DATA

```
{
  "csutId"       : 6543
  "custName"     : "John Smith",
  "address"      : "16040 S. US 27 ...",
  "phone"        : "517-367-7010",
  "email"        : "johnsmith@redline.com"
}
```


But **storing** logically independent data in a single document can compromise data consistency, reusability, and queryability

PURCHASE ORDER

 **SUPREMO CORPORATION**

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ORDER RELATED DATA

```
{
  "po number"    : 23781,
  "date"         : "01/20/2025",
  "custid"       : 6543,
  "line items"   :
    [ { "prodID"   : "304-98632",
        "desc"     : "control arm",
        "unitPrice" : "121.86",
        "quantity" : 2
      },
      ...
    ]
}
```

CUSTOMER RELATED DATA

```
{
  "csutId"       : 6543
  "custName"     : "John Smith",
  "address"      : "16040 S. US 27 ...",
  "phone"        : "517-367-7010",
  "email"        : "johnsmith@redline.com"
}
```

Breakthrough insight: the purchase order data being stored is the same, it is just stored in different formats

ORDER DATA			
PONUM	DATE	C_ID	INST
...
...
...

CUSTOMER DATA			
C_ID	NAME	PHONE	ADDR
...
...
...

LINE_ITEMS DATA			
PONUM	L_ID	PCODE	QTY
...
...
...

PRODUCT DATA			
PCODE	PNAME	DESC	PRICE
...
...
...



ORDER RELATED DATA	
{	
"po number"	: 23781,
"date"	: "01/20/2025",
"custid"	: 6543,
"line items"	:
[{	"prodID" : "304-98632",
"desc"	: "control arm",
"unitPrice"	: "121.86"
"quantity"	: 2
},	
...	
}	

CUSTOMER RELATED DATA	
{	
"csutId"	: 6543
"custName"	: "John Smith",
"address"	: "16040 S. US 27 ...",
"phone"	: "517-367-7010",
"email"	: "johnsmith@redline.com"
}	

New JSON Duality Views declare how to map data between JSON and tables

ORDER DATA			
PONUM	DATE	C_ID	INST
...
...
...

CUSTOMER DATA			
C_ID	NAME	PHONE	ADDR
...
...
...

LINE_ITEMS DATA			
PONUM	L_ID	PCODE	QTY
...
...
...

PRODUCT DATA			
PCODE	PNAME	DESC	PRICE
...
...
...



*JSON operations
converted to reads
or writes of tables*

ORDER RELATED DATA	
{	
"po number"	: 23781,
"date"	: "01/20/2025",
"custid"	: 6543,
"line items"	:
[{	"prodID" : "304-98632",
"desc"	: "control arm",
"unitPrice"	: "121.86"
"quantity"	: 2
},	
...	

CUSTOMER RELATED DATA	
{	
"csutId"	: 6543
"custName"	: "John Smith",
"address"	: "16040 S. US 27 ...",
"phone"	: "517-367-7010",
"email"	: "johnsmith@redline.com"
}	

Apps get the best of JSON and Relational, at the same time, on the same data

Duality views can even provide each app ALL the data it needs in a single document

PURCHASE ORDER

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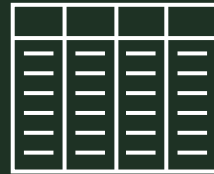
 **Full Purchase Order**
JSON

```
{
  "PO Number" : "23781",
  "date"      : "01/20/2025",
  "customer"  : "John Smith",
  "Address"   : "16040 S. US 27 ...",
  "line items": [
    { "id" : "304-98632", "desc": ... },
    { "id" : "501-35587", "desc": ... },
    { "id" : "886-19386", "desc": ... }
  ]
}
```

Using JSON with Oracle Database is now simpler than using JSON with a pure JSON databases

JSON Duality Views together with new Graph Views go beyond converging data types

They **unify** the key data types



ORDERS INFO

CUSTOMER INFO

ORDER ITEM INFO

PRODUCT INFO

Relational, JSON, and Graph Engineered to Work Together



“Oracle’s JSON Relational Duality, a truly revolutionary solution, is perhaps one of the most important innovations in information science in 20 years.”

Carl Olofson, Research VP,
Data Management Software, IDC

Oracle's Database Strategy

Bring AI to your data,
and engineer them together





Databases are great at querying business data that is stored as strings, numbers, and dates

But not at querying **human-centric data** such as images, documents, and videos

AI Vector Search now makes it easy to query the content of documents, pictures, and videos



An **AI Vector** is a sequence of numbers, called dimensions, that represent the **semantic content** of a document, image, or video

Developers create a vector for an object by just passing the object to a built-in vectorization function

Oracle 23ai natively **stores** vectors and **compares** vectors to find objects with **similar semantic content**

Engineering AI and data together enables enterprises to easily combine business data search with AI Vector Search

Example:

Find the top matching support incidents but limit it to incidents for products I own



Support Rep
Jane Doe



- ✓ Spontaneous reboot
- ✓ Resolved
- ✓ Applied OS Update 42

```
SELECT ...  
FROM   Support_Requests S,  
WHERE  S.prod_id IN (SELECT p.id FROM purchases  
                      WHERE cust_id= :me)  
ORDER BY VECTOR_DISTANCE(request_vector, :search_vector);
```

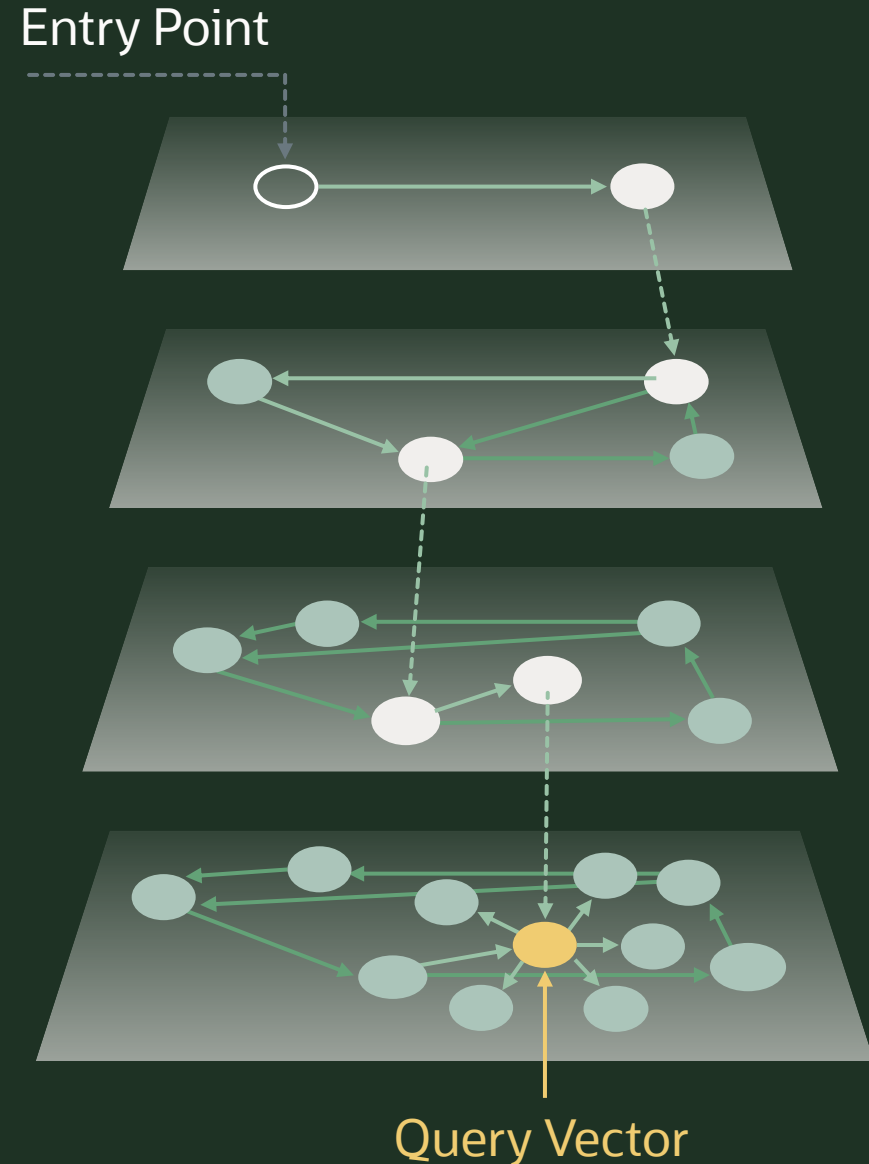
Ultra simple and powerful

Combines customer data, product data, and AI search in 5 lines of SQL!

All data is fully consistent

Single integrated solution

Oracle database accelerates
AI Vector Search using
sophisticated new **vector indexes**
Runs AI Search in milliseconds





Every mission-critical feature
of Oracle Database works
transparently with AI Vectors

AI Vectors can be used
immediately in enterprise
apps of any scale or criticality



Real-Application Cluster



Parallel SQL



Transactions



Security



Analytics



Disaster Recovery

Retrieval Augmented Generation enables users talk to their data



Oracle 23ai improves Generative AI by augmenting **LLM prompts** with **private database content** that is found using any combination of data and AI Vector search

Enables LLMs to use business data to produce better and more accurate answers to user questions while keeping business data secure

Retrieval Augmented Generation (RAG)

Enterprises are already using Oracle AI Vector Search to create innovative new solutions



Visual Search for Products

Find products that are similar to a user provided image



Real-time offer management

Enable merchants to present the right offers to consumers at checkout



Fraud Detection

Multi-lingual search for similar insurance claims that were found to be fraudulent



Real-time intelligent assistant

Use RAG to answers customer questions about products

Database 23ai includes many other AI Capabilities



Translating natural language into SQL using **Select AI**



Implementing over **30 ML algorithms** inside the DB



Running Distributed AI with **GoldenGate 23ai**



Scaling Mission-critical AI using **Exadata**



Creating vectors inside DB using the **ONNX** framework



Interfacing with popular AI Dev Tools incl. **LangChain**

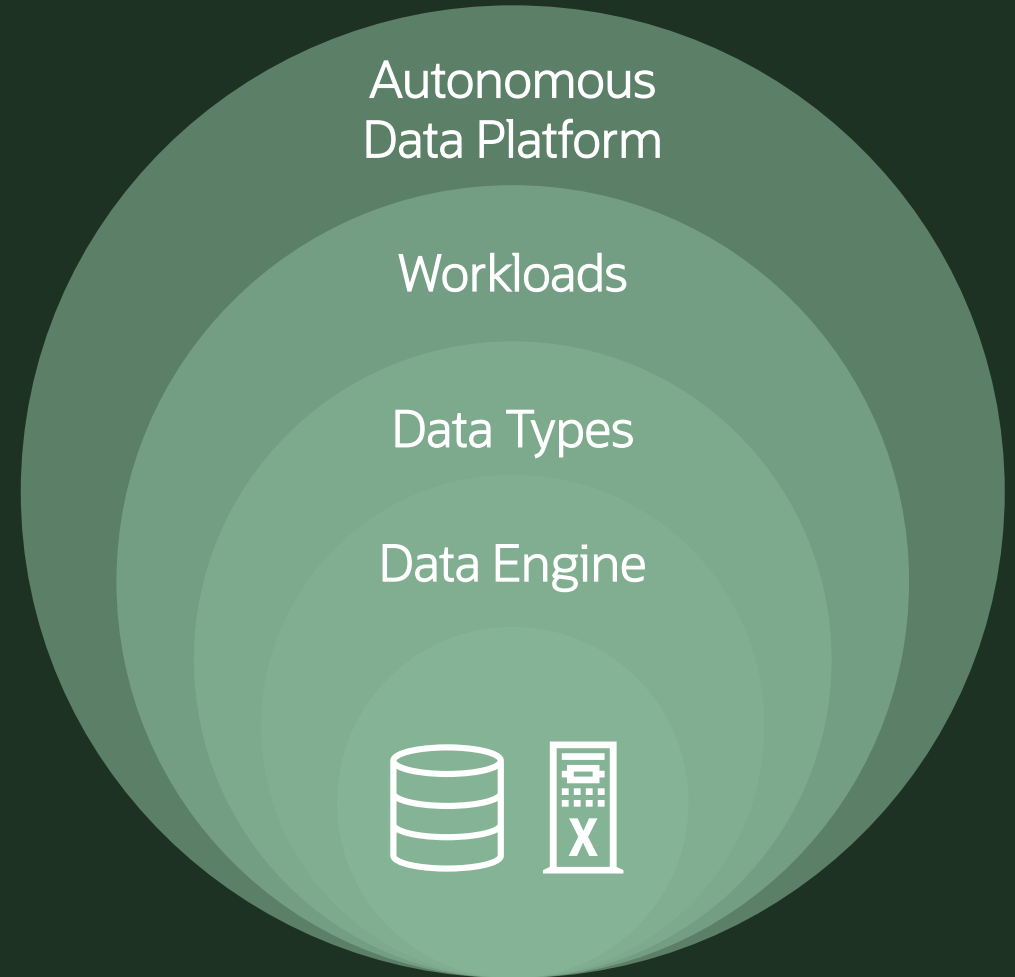
All Oracle Database AI capabilities are provided for no additional charge

Key Takeaways

Complexity is **unavoidable** when apps are built using technologies designed in isolation

Oracle's strategy is to engineer all modern data technologies to work together

Improving synergy, efficiency, and data integrity while helping reduce costs



Engineered to Work Together



All data types
and workloads



Hardware and
software



OLTP, DW,
and Data Lake



Full mission
critical stack



Apps and
data together



AI and
app dev

ORACLE

